CEIG - Spanish Computer Graphics Conference (2014)
Pere-Pau Vázquez and Adolfo Muñoz (Editors)

Tracking of Deformable Volumes for Augmented Reality

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Abstract

Traditional methods for deformable object tracking approximate objects as surfaces, since they only seek for results that are visually feasible. However, the physical properties of the objects involve parameters such as elasticity which affect their mechanical behaviour and cannot be well described in this way. This work presents a new framework for tracking deformable and elastic objects using computer vision techniques. Unlike most extended methods, objects are represented as volumes intending to go beyond a visually appealing result, looking for a physically realistic one.

Categories and Subject Descriptors (according to ACM CCS): I.4.8 [Image Processing and Computer Vision]: Scene Analysis—Tracking

1. Introduction

There are several techniques to detect and track non-rigid objects. Some of them are based on the physical properties of materials while other approaches use statistical learning and geometric constraints.

Within the physical based methods, authors like [TGS00] propose the use of FEMs representing objects as a tetrahedral mesh. They use a stereo rig and assume a lineal isotropic material which behaves well under small deformations.

In order to overcome the computational complexity of FEMs, statistical models propose representing objects as a subspace that is inferred from a training process. One of the most important works in this field is the method presented by [CET01] for facial tracking. As it is shown in [SF11] it can be extended to any kind of volume or surface.

In the group of geometrical constraints, the most extended model is based on the approximation of objects as non extensible surfaces. Under this model the geodesic distance of the vertices of the surface is assumed to be constant [PHB11].

2. Future Work

The state of the art shows a clear trend towards statistical and geometric models. However they are usually restricted to non elastic materials and only seek for results that are visually feasible. Some works [San11] have demonstrated that, in some cases, mass-spring models can behave similar to FEMs reducing significantly the computational complexity. This fact allows us to propose returning to tracking methods based on physical properties, improving accuracy, and having a fully volumetric representation of the object.

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ACKNOWLEDGMENTS

Work funded by the Spanish Ministry of Economy and Competitiveness. Project ELASTRACK (TIN2012-33879).

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